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Central Nervous Pathways Involved in Conditioning

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The present series of experiments is the beginning of a project aimed at determining the critical neural structures involved in the performance of a conditioned withdrawal of one forelimb to a flashing light signal. The unconditioned stimulus is an electric shock to the forelimb. The left optic tract is sectioned in all animals, thereby restricting the input to the right hemisphere.

Surgical removal of those pathways and centers suspected of playing a role is being carried out in stages. At present the most extensive surgery which the conditioned response has survived is the following: Ablation of the entire right cerebral cortex and left occipital cortex, plus midline section of the corpus callosum, anterior, posterior and habenular commissures, massa intermedia, and commissures of the superior and inferior colliculi.

Theories for the neural basis of conditioning which assume formation of new connections between cortical receptor and motor centers, even by devious and indirect routes, are difficult to reconcile with these results. The findings are more easily accounted for on the assumption that the conditioning process involves development of a central facilitory set in the remaining cortical remnant resulting from numerous and varied stimuli associated with the specific conditioned stimulus, which then primes the lower centers in a selective manner, such that the conditioned stimulus will trigger the conditioned response, even in the absence of direct cortical stimulation. (Supported in part by grants from the Commonwealth Fund and by grant no. M3372, United States Public Health Service.)